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Division of Highways
Materials and Research Department

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Mr. A. L. Himelhoch
District Engineer
District VII
Calif. Division of Highways
Los Angeles, California

Attention: Mr. A. D. Mayfield

Dear Sir:

Submitted for your consideration is a report of:

MARK KEPPEL HIGH SCHOOL

CONCRETE WALL NOISE BARRIER

Study by . . . . . Structural Materials Section

Under direction of . . . . . E. F. Nordlin

Measurements by . . . . . Louis Bourget

Report prepared by . . . . . Louis Bourget

Very truly yours,

F. N. Hveem
Materials and Research Engineer

By Eric F. Nordlin
Eric F. Nordlin
Supervising Highway Engineer

LB:mw
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JEWilson

INTRODUCTION

At the request of Mr. A. D. Mayfield, Assistant District Engineer of District VII, the noise reduction properties of a concrete block wall at Mark Keppel High School, a two story structure, have been measured incidental to long term studies of truck traffic noise in the greater Los Angeles area.

The concrete block wall varies from 10 to 12 feet in height along the south side of San Bernardino Freeway at the school site in Alhambra, just east of Almansor Street.

Noise attenuation properties are discussed for various heights beyond the wall because the effectiveness of any barrier decreases as we tend to "look over" the barrier.

Information is included on the maximum noise intrusion level considered acceptable for school classrooms and means for attaining this condition in adverse surroundings. Two practical examples are cited for their informational value.

DISCUSSION

The noise barrier properties of the masonry wall were obtained from simultaneous measurements made both inside and outside of the wall (on the same trucks while passing) at the west end of the school yard.

Both instruments were placed at the same distance from the freeway as the most exposed end of the projecting east wing of the main building.

At a measuring height of 7 feet above the ground surface in the school yard, the average peak truck noise reduction is 13 decibels.

At the somewhat higher elevation of the nearest first floor classroom windows the reduction of peak noises will average about 10 decibels.

At the much higher elevation of the second story window apertures the noise reduction is only 2 to 3 decibels because we now look over the barrier and derive but slight reflective benefits.

It is possible to achieve peak noise attenuation on the order of 15 to 20 decibels by means of masonry, concrete or earthen barriers providing the barrier is higher than the tallest truck exhaust pipes, say 15 feet above the pavement grade line, but only for single storied structures and residences that remain completely hidden from view of the tallest vehicles. Obviously the upper floors of schools or multiple storied apartment houses will receive less protection in proportion to their altitude until finally a height is reached where there is virtually no protection at all.

Acoustical people consider acceptability of school classrooms from the standpoint of measured noise penetration, using the Noise Criterion (NC) curves developed by Dr. Leo L. Beranek. The recommended noise criterion curve is NC-25, which is about the same as a 35 dbA level. This figure represents a desirable limit for noise penetration into an empty classroom from either ventilating equipment or external noise sources.

As you may suspect, such a desirable figure is not always met in practice and can usually be stretched to 40 or 45 dbA, except for auditoriums or hearing test rooms.

At the Mark Keppel east wing the exterior peak noise levels reach an average of 85 dbA at the second floor windows and about 75 dbA at the first floor windows. Therefore, to achieve the desired result of no more than 40 to 45 dbA inside

of the nearest classrooms, a noise reduction of about 40 decibels would be required.

Noise attenuation of this order has been achieved in two schools in District IV. In each case our right-of-way requirements forced encroachment on part of the school properties which may have had some bearing on vulnerability.

The means employed to achieve the noise reduction was simply to plug all window apertures with glass block, mortared into place, and then to ventilate the rooms by mechanical means. The John Swett School in San Francisco was the first school treated. This school already had ventilation equipment so the job was relatively simple. The Lakeview School in Oakland, along MacArthur Freeway, is the second example. This school had no ventilating equipment so it had to be provided. In both cases the exterior noise penetration was reduced to desirable levels. All work was coordinated through the Division of Architecture and met local fire ordinance requirements. These comments are offered for their informational value on how similar problems have been solved. The technique described represents the most effective presently known means by which noise reduction of the order mentioned can be and has been accomplished.

REFERENCES

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Beranek, Leo L., Revised Criteria for Noise in Buildings, NOISE CONTROL, January 1957.

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